Marking Scheme

Compiled by Joe

只供 Joe Cheung & his partner 學員使用

Section A(1)

1. $\dfrac{(x^5y)^{-4}}{x^{14}y^{20}}=\dfrac{x^{-20}y^{-4}}{x^{14}y^{20}}=x^{-20-14}y^{-4-20}=x^{-34}y^{-24}=\dfrac{1}{x^{34}y^{24}}$ 1M + 1M + 1A

2. (a) $4x^2+28xy+49y^2=(2x+7y)^2$ 1A

(b) $4x^2+28xy+49y^2-8x-28y$

$=(2x+7y)^2-4(2x+7y)$ 1M

$=(2x+7y)(2x+7y-4)$ 1A

3. (a) For $n=6$,

$\sin(5\times 6)^\circ=\sin 30^\circ=0.5$ 1A

(b) $\dfrac{\sqrt{2}}{2}$, $\dfrac{\sqrt{3}}{2}$ 2A

4. (a) $3(h-4k)=6h-5$

$3h-12k=6h-5$ 1M

$-12k=3h-5$ 1M

$k=\dfrac{3h-5}{-12}$

$k=\dfrac{5-3h}{12}$ 1A

(b) $k=\dfrac{5-3h}{12}$

$k'=\dfrac{5-3(h-4)}{12}=\dfrac{5-3h+12}{12}=\dfrac{5-3h}{12}+\dfrac{12}{12}=k+1$

$\therefore$ k is increased by 1. 1A

k 增加 1。

5. (a) $-2x+3<\dfrac{2x+5}{6}$

$-12x+18<2x+5$ 1M

$-12x-2x<5-18$ 1M

$-14x<-13$

$x>\dfrac{13}{14}$ 1A

(b) 2, 3, 5, 7 1A

6. (a) Height of Susan 美玲的高度

$=\dfrac{165}{(1+10\%)}$ 1M

$=\dfrac{165}{1.1}$

$=150$ cm 1A

(b) Height of Amy 佩詩的高度

$=150(1-10\%)$

$=135$ cm 1A

The required percentage 所求百分率

$=\dfrac{165-135}{165}\times 100\%$

$=18\dfrac{2}{11}\%$ (or 18.2%) 1A

7. (a) L is the angle bisector of $\angle AOB$. 1A

L 為 $\angle AOB$ 的角平分線。

(b) Let $M(r, \theta)$ be the polar coordinates of the point of intersection of L and AB.

設 L 與 AB 的交點的極坐標為 $M(r, \theta)$。

$\angle AOB = 110° - 50° = 60°$ 1A

$\angle MOB = 30°$

$\cos 30° = \frac{r}{12}$ 1M

$r = 6\sqrt{3}$ 1A

$\theta = 50° + 30° = 80°$ 1A

$\therefore \quad M(6\sqrt{3}, 80°)$

8. Let x and y be the number of matches that team F wins and draws respectively.

設球隊 F 勝出的場數與賽和的場數分別為 x 及 y。

$$\begin{cases} \frac{x}{y} = \frac{3}{1} & \text{......(1)} \\ 3x + y = 50 & \text{......(2)} \end{cases}$$ 1A + 1A

From (1): $x = 3y$ ……(3)

Put (3) into (2), $3(3y) + y = 50$ 1A

$y = 5$

Put $y = 5$ into (3), $x = 3(5) = 15$ 1A

$\therefore \quad x = 15, y = 5$

$\therefore$ Number of matches that team F loses 球隊 F 輸掉的場數

$= 27 - 15 - 5 = 7$ 1M + 1A

SECTION A(2)

9. (a) $\angle BDA = \angle BCE$ (Given)(已知)

$BD = BC$ (Given)(已知)

$\angle ABD = \angle EBC = 90^\circ$ (Given)(已知)

$\therefore$ $\Delta ABD \cong \Delta EBC$ (ASA)

Case I: Any correct proof with correct reasons.	3M
Case II: Any correct proof without reasons.	2M
Case III: Incomplete proof with any one correct step and one correct reason.	1M

(b) (i) $\angle ADB = \angle CBD$

$\therefore$ $BC \mathbin{//} AD$ (alt. ∠s, equal)(錯角相等)

$\angle CBE = \angle BFA$ (alt. ∠s, $BC \mathbin{//} AD$)(錯角，$BC \mathbin{//} AD$)

$\angle CEB = \angle BAF$ (corr. ∠s, ≅ Δs)(全等Δ對應角)

$\angle BCE = 180^\circ - \angle CBE - \angle CEB$ (∠ sum of Δ)(Δ內角和)

$= 180^\circ - \angle BFA - \angle BAF$ (∠ sum of Δ)(Δ內角和)

$= \angle FBA$

$\therefore$ $\Delta CEB \sim \Delta BAF$ (AAA)

Case I: Any correct proof with correct reasons.	3M
Case II: Any correct proof without reasons.	2M
Case III: Incomplete proof with any one correct step and one correct reason.	1M

(ii) ΔDBF 1A

10. (a) $f(x)=(x+m)(x+n)(x-1)+5$

$f(0)=(0+m)(0+n)(0-1)+5$ 1M

$0=-mn+5$

$mn=5$ 1A

$\therefore \quad m=-5,\ n=-1$ 1A

(b) $f(x)=(x-5)(x-1)(x-1)+5=x^3-7x^2+11x$ 1M

$f(x)-g(x)=x^3-7x^2+11x-(x^3-9x^2+10x+k)=2x^2+x-k$ 1M

$f(x)-g(x)=0$

$2x^2+x-k=0$

$\Delta\geq 0$ 1M

$(1)^2-4(2)(-k)\geq 0$

$1+8k\geq 0$

$k\geq -\frac{1}{8}$ 1A

11. (a) Maximum absolute error 最大絕對誤差 = 5 mL 1A

(b) Upper limit 上限 = 800 + 5 = 805 mL

Lower limit 下限 = 800 – 5 = 795 mL 1M

$\therefore$ $795 \le x < 805$ 1A

(c) (i) Upper limit of 48 packs of orange juice

48 包橙汁的總體積上限

$= 805 \times 48$ 1M

$= 38640$ mL

$= 38.640$ L 1M

< 38.7 L

$\therefore$ It is impossible 不可能 1A

(ii) Lower limit of a glass of orange juice

一杯橙汁的下限

$= 250 - 2.5$

$= 247.5$ mL

Number of glass of orange juice

橙汁的杯數

$= \dfrac{38640}{247.5}$ 1M

≈ 156.12

< 157

$\therefore$ It is impossible 不可能 1A

12. (a) (i) Outer total surface area 外側的總表面面積

$= 20 \times 40 \times 2 + 20 \times 30 \times 2 + 40 \times 30$ 1M

$= 4000 \text{ cm}^3$ 1A

(ii) Capacity 容量

$= 20 \times 40 \times 30$ 1M

$= 24000 \text{ cm}^3$ 1A

(b) $\tan\theta = \frac{20}{40} = \frac{1}{2}$ 1M

$\theta = 26.6°$ 1A

SECTION B

13. $y = ax^2 - 3x + 9$

$\alpha + \beta = -\frac{-3}{a} = \frac{3}{a}$ ....(1)

$\alpha\beta = \frac{9}{a}$ ....(2) 1M

$AO = 2BO$

$-\alpha = 2\beta$

$\alpha = -2\beta$ 1M

Put $\alpha = -2\beta$ into (1),

$-2\beta + \beta = \frac{3}{a}$

$-\beta = \frac{3}{a}$

$\beta = -\frac{3}{a}$ 1M

$\therefore \quad \alpha = -2\beta = -2(-\frac{3}{a}) = \frac{6}{a}$ 1M

Put $\beta = -\frac{3}{a}$ and $\alpha = \frac{6}{a}$ into (2),

$(\frac{6}{a})(-\frac{3}{a}) = \frac{9}{a}$

$a = -2$

$\therefore \quad a = -2, \ \alpha = \frac{6}{-2} = -3, \ \beta = \frac{3}{2}$ 1A

14. (a) For Y: When $N = 2.5$,

$$2.5 = \log_{100} \frac{E}{10}$$ 1M

$$100^{2.5} = \frac{E}{10}$$

$$10^5 = \frac{E}{10}$$

$$10^6 = E$$ 1A

For X: When $E = 10^6$, $M = 8$

$$8 = \log 10^6 + k$$ 1M

$$8 = 6 + k$$

$$k = 2$$ 1A

(b) For X: When $M = a$

$$a = \log E + 2$$

$$a - 2 = \log E$$

$$E = 10^{a-2}$$ 1M

For Y: When $E = 10^{a-2}$,

$$N = \log_{100} \frac{10^{a-2}}{10}$$ 1M

$$N = \log_{100} 10^{a-3}$$

$$N = (a-3)\log_{100} 10$$ 1M

$$N = (a-3)(\frac{1}{2})$$

$$N = \frac{a-3}{2}$$ 1A

15. (a) $y = -5x^2 + 24x$

$y = -5(x^2 - \frac{24}{5}x)$ 1M

$y = -5[x^2 - \frac{24}{5}x + (\frac{12}{5})^2 - (\frac{12}{5})^2]$ 1M

$y = -5[(x - \frac{12}{5})^2 - \frac{144}{25}]$

$y = -5(x - \frac{12}{5})^2 + \frac{144}{5}$

$\therefore$ Vertex 頂點 $= (\frac{12}{5}, \frac{144}{5})$ 1A

(b) (i) $\Delta ABC \sim \Delta RQC$ (AAA) 1M

$\frac{RC}{AC} = \frac{RQ}{AB}$

$\frac{RC}{8} = \frac{x}{6}$

$RC = \frac{4x}{3}$ 1A

$\Delta ABC \sim \Delta SBP$ (AAA)

$\frac{BS}{BA} = \frac{SP}{AC}$

$\frac{BS}{6} = \frac{x}{8}$

$BS = \frac{3x}{4}$ 1A

$\therefore \quad SR = 10 - \frac{3x}{4} - \frac{4x}{3} = 10 - \frac{25x}{12}$ 1A

$\therefore \quad Y = x(10 - \frac{25x}{12}) = 10x - \frac{25x^2}{12}$ 1A

(ii) $Y = 10x - \frac{25x^2}{12}$

$Y = \frac{5}{12}(-5x^2 + 24x)$ 1M

$Y = \frac{5}{12}[-5(x - \frac{12}{5})^2 + \frac{144}{5}]$ From (a) 1M

$Y = -\frac{25}{12}(x - \frac{12}{5})^2 + 12$

∴ The maximum value of the area is 12 cm^2.

面積的極大值為 12 cm^2。

∴ No 不能。 1A

1. A

$$(-7)^{300} \cdot \frac{1}{7^{100}} = (7)^{300} \cdot \frac{1}{7^{100}} = 7^{300-100} = 7^{200}$$

2. B

$$4 - x^2 + 4xy - 4y^2 = 4 - (x^2 - 4xy + 4y^2) = 2^2 - (x - 2y)^2 = (2 + x - 2y)(2 - x + 2y)$$

3. C

$$\frac{27 \times 30 + 22 \times 20}{50} = 25 \text{ page頁/min分鐘}$$

4. B

$$\text{Cost 成本} = \frac{700}{1 + 40\%} = \$500$$

$$\text{Profit 盈利} = 700(1 - 15\%) - 500 = \$95$$

5. A

$p = -5$, $q = -1$, $r = 2$.

$$\frac{p - q}{r} = \frac{-5 - (-1)}{2} = -2$$

6. D

$$hx(x + 2) + x^2 \equiv 3kx(x + 1) + 4x$$

Put $x = -1$,

$$h(-1)(-1 + 2) + (-1)^2 = 3k(-1)(-1 + 1) + 4(-1)$$

$$h(-1)(1) + 1 = 0 - 4$$

$$-h + 1 = -4$$

$$h = 5$$

7. B

$AB = \sqrt{(-2-1)^2 + (0-5)^2} = \sqrt{34}$

For Choice A: $AC = \sqrt{(-2-1)^2 + (5-5)^2} = 3$

For Choice B: $AC = \sqrt{(4-1)^2 + (0-5)^2} = \sqrt{34}$

For Choice C: $AC = \sqrt{(0-1)^2 + (-4-5)^2} = \sqrt{82}$

For Choice D: $AC = \sqrt{(4-1)^2 + (1-5)^2} = 5$

8. D

$h + k = 2(360^\circ) - 70^\circ = 650^\circ$

9. B

Let x and y be the number of pens and rubbers bought respectively.

設 x 及 y 分別為購買了的原子筆及橡皮擦數量。

$$\begin{cases} 4.5x + 2.8y = 92.7 \text{ ....(1)} \\ x = 2y - 3 \text{ ....(2)} \end{cases}$$

Sub. (2) into (1),

$$\begin{aligned} 4.5(2y-3) + 2.8y &= 92.7 \\ 9y - 13.5 + 2.8y &= 92.7 \\ 11.8y &= 106.2 \\ y &= 9 \end{aligned}$$

Put $y = 9$ into (2), $x = 2(9) - 3 = 15$

∴ The total number of pens and rubbers bought

購買了的原子筆及橡皮擦的總數

$= 9 + 15 = 24$

10. B

∵ The graph opens downwards.

圖像開口向下。

∴ $a < 0$

The roots of the graphs are –3 and 8.

圖像的根為–3 及 8。

I. ✓

II. $y = -\frac{1}{2}x^2 + \frac{5}{2}x + 12 = -\frac{1}{2}(x^2 - 5x - 24) = -\frac{1}{2}(x+3)(x-8)$ ✓

III. $y = -15x - (72 - 3x^2) = -15x - 72 + 3x^2 = 3x^2 - 15x - 72$ ✗

11. B

$f(x) = 2x^2 + kx - 1$

$$f(2) = f\left(\frac{1}{2}\right)$$

$$2(2)^2 + k(2) - 1 = 2\left(\frac{1}{2}\right)^2 + k\left(\frac{1}{2}\right) - 1$$

$$8 + 2k - 1 = \frac{1}{2} + \frac{1}{2}k - 1$$

$$k = -5$$

12. D

∵ It has a maximum point at (3, 6).

它於(3, 6)有極大點。

∴ $a < 0$, $h = 3$ and $k = 6$.

∴ The function is $f(x) = a(x-3)^2 + 6$ and a is negative.

函數為 $f(x) = a(x-3)^2 + 6$ 及 a 為負數。

13. C

Let $x = -2$ and $y = -1$

I. $\dfrac{2}{3x} = \dfrac{2}{3(-2)} = -\dfrac{1}{3}$

$\dfrac{2}{3y} = \dfrac{2}{3(-1)} = -\dfrac{2}{3}$

$\therefore \quad \dfrac{2}{3x} < \dfrac{2}{3y}$ ✗

II. $6 - 2x = 6 - 2(-2) = 10$

$6 - 2y = 6 - 2(-1) = 8$

$\therefore \quad 6 - 2x > 6 - 2y$ ✓

III. $-xy = -(-2)(-1) = -2$

$-y^2 = -(-1)^2 = -1$

$-xy < -y^2$ ✓

14. C

The 1st pattern: number of dots 第 1 個圖案的點子數量 $= 1^2 + 0 = 1$

The 2nd pattern: number of dots 第 2 個圖案的點子數量$= 2^2 + 1 = 5$

The 3rd pattern: number of dots 第 3 個圖案的點子數量$= 3^2 + 2 = 11$

The 4th pattern: number of dots 第 4 個圖案的點子數量$= 4^2 + 3 = 19$

⋮

The 7th pattern: number of dots 第 7 個圖案的點子數量 $= 7^2 + 6 = 55$

15. A

$$\frac{\sin(90° - \theta)\tan(360° - \theta)}{\cos(180° + \theta)} = \frac{\cos\theta(-\tan\theta)}{-\cos\theta} = \tan\theta$$

16. D

$\angle ACB = \angle ADC = \theta$

$AC = CD\sin\theta = x\sin\theta$

$BC = AC\cos\theta = x\sin\theta\cos\theta$

17. B

The exterior angle of the polygon 該多邊形的一外角 $= \dfrac{360°}{n}$

The interior angle of the polygon 該多邊形的一內角 $= \dfrac{360°}{n} + 90°$

$$\frac{360°}{n} + \frac{360°}{n} + 90° = 180°$$
$$n = 8$$

I. The value of n is 8. ✓

n 的值為 8。

II. The interior angle of the polygon = $\dfrac{360°}{8} + 90° = 135°$ ✓

該多邊形的一內角為 135°。

III. The number of axes of reflectional symmetry of the polygon is 8. ✗

該多邊形的反射對稱軸的數目為 8。

18. C

Volume 體積

$= (8 \times 12 - 6 \times 8) \times 10$

$= 480\text{ cm}^3$

19. D

Let r_A, r_B and r_C be the radius of A, B and C respectively.

設 r_A、r_B 及 r_C 分別為 A、B 及 C 的半徑。

Let A_A, A_B and A_C be the curved surface area of A, B and C respectively.

設 A_A、A_B 及 A_C 分別為 A、B 及 C 的曲面面積。

Let V_A, V_B and V_C be the volume of A, B and C respectively.

設 V_A、V_B 及 V_C 分別為 A、B 及 C 的體積。

$$\left(\frac{r_A}{r_B}\right)^3 = \frac{V_A}{V_B} \qquad \left(\frac{r_B}{r_C}\right)^2 = \frac{A_B}{A_C}$$

$$\left(\frac{r_A}{r_B}\right)^3 = \frac{64}{27} \quad , \quad \left(\frac{r_B}{r_C}\right)^2 = \frac{16}{25}$$

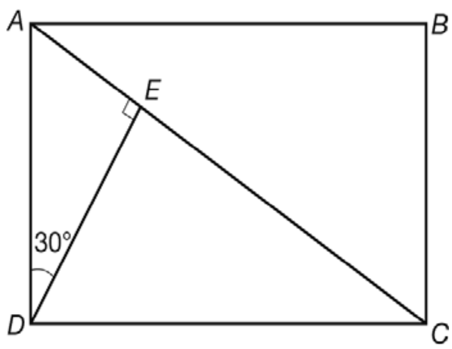
$$\frac{r_A}{r_B} = \frac{4}{3} \qquad \frac{r_B}{r_C} = \frac{4}{5}$$

$\therefore \quad r_A : r_B : r_C = 16 : 12 : 15$

$\therefore \quad r_A : r_C = 16 : 15$

20. D

Let $AD = x$ cm, then $DE = x\cos 30^\circ$.



$$\frac{1}{2}(x)(x\cos 30^\circ)\sin 30^\circ = 3$$

$$\frac{\sqrt{3}}{8}x^2 = 3$$

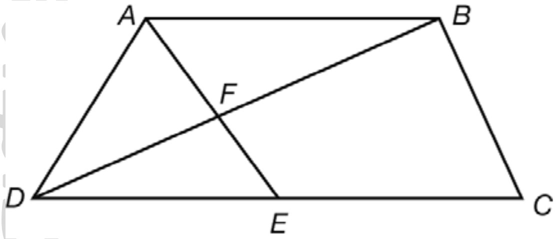
$$x^2 = 8\sqrt{3}$$

$\angle CAD = 60^\circ$

$CD = AD\tan 60^\circ = \sqrt{3}x$ cm

$\therefore \quad \text{Area} = AD \times CD = x \times \sqrt{3}x = \sqrt{3}x^2 = \sqrt{3}(8\sqrt{3}) = 24\text{ cm}^2$

21. C



∵ $\Delta DEF \sim \Delta BAF$ (AAA)

∴ $\dfrac{\text{Area of } \Delta DEF}{\text{Area of } \Delta BAF} = \left(\dfrac{DE}{BA}\right)^2$

$\dfrac{25}{\text{Area of } \Delta BAF} = \left(\dfrac{2.5}{3}\right)^2$

$\text{Area of } \Delta BAF = 36 \text{ cm}^2$

∵ ΔDEF and ΔDFA have the same height.

ΔDEF 及 ΔDFA 有相同的高。

∴ $\dfrac{\text{Area of } \Delta DEF}{\text{Area of } \Delta DFA} = \dfrac{EF}{FA}$

$\dfrac{25}{\text{Area of } \Delta DFA} = \dfrac{2.5}{3}$

$\text{Area of } \Delta DFA = 30 \text{ cm}^2$

∵ ΔDAE and ΔDBE have the same height and base.

ΔDAE 及 ΔDBE 有相同的高和底。

∴ Area of ΔDBE = Area of ΔDAE

$= 25 + 30$

$= 55 \text{ cm}^2$

∵ ΔCBE and ΔDBE have the same height and base.

ΔCBE 及 ΔDBE 有相同的高和底。

∴ Area of ΔCBE = Area of ΔDBE

$= 55 \text{ cm}^2$

∴ Area of $ABCD$ = Area of ΔCBE + Area of ΔDBE + Area of ΔDFA + Area of ΔBAF

$= 55 + 55 + 30 + 36$

$= 176 \text{ cm}^2$

22. D

The new rectangular coordinates of $P = (-2, -2\sqrt{3})$

P 的新直角坐標 $= (-2, -2\sqrt{3})$

Let the polar coordinates of new $P = (r, \theta)$

設 P 的新極坐標 $= (r, \theta)$

$$r = \sqrt{(-2)^2 + (-2\sqrt{3})^2} = 4$$

$$\tan\theta = \frac{-2\sqrt{3}}{-2}$$

$$\theta = 60°\text{(rejected)} \qquad \text{or} \qquad \theta = 240°$$

$\therefore \quad P = (4, 240^{\circ})$

23. B

$$-\frac{1}{-3} \times -\frac{k}{-3} = -1$$

$$\frac{k}{9} = -1$$

$$k = -9$$

24. D

Slope 斜率 $= -\frac{1}{a}$

∵ Slope is positive.

斜率為正數。

∴ $-\frac{1}{a} > 0$

$a < 0$

x-intercept $= -\frac{b}{1} = -b$

∵ x-intercept is positive.

x-截距為正數。

∴ $-b > 0$

$b < 0$

25. C

$$\left(\frac{1}{4000}\right)^2 = \frac{25}{\text{the actual area 實際面積}}$$

the actual area 實際面積 $= 400000000\text{ cm}^2 = 40000\text{ m}^2$

26. A

Let $x = 3k$, $y = 2k$, $z = 5k$

$(3x - y - z) : (2x + 3y - 2z)$

$= [3(3k) - (2k) - (5k)] : [2(3k) + 3(2k) - 2(5k)]$

$= 2k : 2k$

$= 1 : 1$

27. B

$$z=\frac{k\sqrt{y}}{x^2}$$

$$y=\left(\frac{x^2z}{k}\right)^2=\frac{x^4z^2}{k^2}$$

New $y' = \frac{(0.8x)^4(1.875z)^2}{k^2}=\frac{1.44x^4z^2}{k^2}=1.44y$

Percentage change 百分變化

$$=\frac{1.44y-y}{y}\times 100\%=44\%$$

28. C

The least possible value of n

n 的最少可能值

$$=\frac{(50-0.5)\times 1000}{(60+0.5)}$$

≈ 818.182

≈ 818

29. B

By triangular inequality

利用三角不等式

$$\begin{cases} x+2x > x+3 \\ 2x+x+3 > x \\ x+x+3 > 2x \end{cases}$$

$$= \begin{cases} x > \frac{3}{2} \\ x > -\frac{3}{2} \\ \text{all real values of } x \\ \text{所有實數} x \end{cases}$$

$\therefore \quad x > \frac{3}{2}$

$\therefore$ The minimum value of x = 2.

x 的最少值= 2。

30. A

$\because$ the mode is 7

眾數為 7。

$\therefore \quad x = 7$

$\because$ the median is 6

中位數為 6。

$\therefore \quad y = 6$

Mean 平均值$= \frac{2+3+3+6+7}{5} = 4.2$

31. A

$$\frac{1}{m-2}-\frac{1}{2+m}=\frac{1}{m-2}-\frac{1}{m+2}=\frac{m+2-(m-2)}{m^2-4}=\frac{4}{m^2-4}$$

32. C

$$(2i)^{100}+(-2i)^{100}=2^{100}i^{100}+(-2)^{100}i^{100}=2^{100}(1)+(2)^{100}(1)=2\times(2)^{100}=2^{101}$$

33. A

$$\alpha^2-3\alpha+1=0$$
$$2\alpha^2-6\alpha+2=0$$
$$2\alpha^2-6\alpha-1+2=-1$$
$$2\alpha^2-6\alpha-1=-1-2$$
$$2\alpha^2-6\alpha-1=-3$$

34. A

$f(x) = -2x^2 + 12x + k$

$$\frac{4(-2)(k)-(12)^2}{4(-2)}=7$$
$$-8k-144=-56$$
$$-8k=88$$
$$k=-11$$

35. D

36. D

For A: $\log 111^{444} = 444 \log 111 = 908.123$

For B: $\log 222^{333} = 333 \log 222 = 781.336$

For C: $\log 333^{222} = 222 \log 333 = 559.983$

For D: $\log 444^{111} = 111 \log 444 = 293.860$

$\therefore$ 444^{111} is the least.

444^{111} 為最小。

37. D

Let $a = k\log 3$ and $b = k\log 2$,

$(a+b):(a+3b)$

$= (k\log 3 + k\log 2):(k\log 3 + 3k\log 2)$

$= [k(\log 3 + \log 2)]:[k(\log 3 + \log 2^3)]$

$= (k\log 6):(k\log 24)$

$= \log 6 : \log 24$

38. C

39. A

Put $x = 0$ into $y = ab^x$,

$ab^{(0)} > 1$

$a > 1$

∵ The value of y increases as x increases.

當 x 增加，y 的值增加。

∴ $b > 0$

$y = ab^x$

$\log_3 y = \log_3 ab^x$

$\log_3 y = \log_3 a + x\log_3 b$

By comparing with $y = mx + c$,

與 $y = mx + c$ 比較，

$m = \log_3 b$, $c = \log_3 a$

$m > 0$, $c > 0$

∴ A is the correct answer.

A 為正確答案。

40. D

$m^2 - 2m + 1 = (m - 1)^2$

$m^2 - 1 = (m + 1)(m - 1)$

$m^3 - 1 = (m - 1)(m^2 + m + 1)$

L.C.M. $= (m - 1)^2(m + 1)(m^2 + m + 1)$

41. A

11001000010001_2

$= 2^{13} + 2^{12} + 2^9 + 2^4 + 2^0$

$= 2^{13} + 2^9 + 2^{12} + 2^4 + 2^0$

$= 2^{13} + 2^9 + 4096 + 16 + 1$

$= 2^{13} + 2^9 + 4113$

42. B

$$\begin{cases} y = 2\sin^2 x & \text{..........(1)} \\ y = -3\cos x & \text{..........(2)} \end{cases}$$

Put (1) into (2),

$$2\sin^2 x = -3\cos x$$

$$2(1-\cos^2 x) + 3\cos x = 0$$

$$2 - 2\cos^2 x + 3\cos x = 0$$

$$2\cos^2 x - 3\cos x - 2 = 0$$

$$(\cos x - 2)(2\cos x + 1) = 0$$

$$\cos x = -\frac{1}{2} \quad \text{or} \quad \cos = 2 \text{ (rejected)}$$

$$x = 120° \quad \text{or} \quad 240°$$

$\therefore$ There are two points of intersections.

有兩個相交點。

43. C

Put (0, 2) into $y = k\cos\left(\frac{1}{2}x + \theta\right) + 2$,

$2 = k\cos\left(\frac{1}{2}(0) + \theta\right) + 2$

$2 = k\cos\theta + 2$

$0 = k\cos\theta$

$0 = \cos\theta$

$\theta = 90°$ or $\theta = 270° = -90°$

Put (180°, 5) and $\theta = 90°$ into $y = k\cos\left(\frac{1}{2}x + \theta\right) + 2$,

$5 = k\cos\left(\frac{1}{2}(180°) + 90°\right) + 2$

$5 = k\cos(180°) + 2$

$5 = -k + 2$

$k = -3$

Put (180°, 5) and $\theta = -90°$ into $y = k\cos\left(\frac{1}{2}x + \theta\right) + 2$,

$5 = k\cos\left(\frac{1}{2}(180°) - 90°\right) + 2$

$5 = k\cos(0°) + 2$

$5 = k + 2$

$k = 3$

44. A

Slope of $ax + by = 0$:

$m = \frac{-a}{b}$

$m > 0$

$\because$ $a > 0$

$\therefore$ The graph of $y = ax^2 + bx$ opens upwards.

$y = ax^2 + bx$ 的圖像開口向上。

$\therefore$ A is the correct answer.

A 為正確答案。

45. B

Note that ΔOAB is a right-angled triangle.

留意ΔOAB 為一直角三角形。

$\therefore$ The circumcentre of ΔOAB is the mid-point of AB, i.e., (3, 4), let's denote the point by M.

ΔOAB 的外心為 AB 的中點，即(3, 4)，將該點標記為 M。

The orthocentre of ΔOAB is O.

ΔOAB 的垂心為 O。

Note that OM is a median of ΔOAB.

留意 OM 為ΔOAB 的中線。

$\therefore$ The centroid, circumcentre and orthocentre of ΔOAB lie on the same straight line, OM.

ΔOAB 的形心、外心及垂心位於同一直線 OM 上。